Rehabilitation of lexical retrieval in aphasia: Evidence from semantic complexity

Swathi Kiran
Boston University

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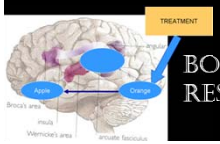
ASHF New Century Research Scholars Grant; ASHF New Investigator Grant, ASHF Clinical Research Grant



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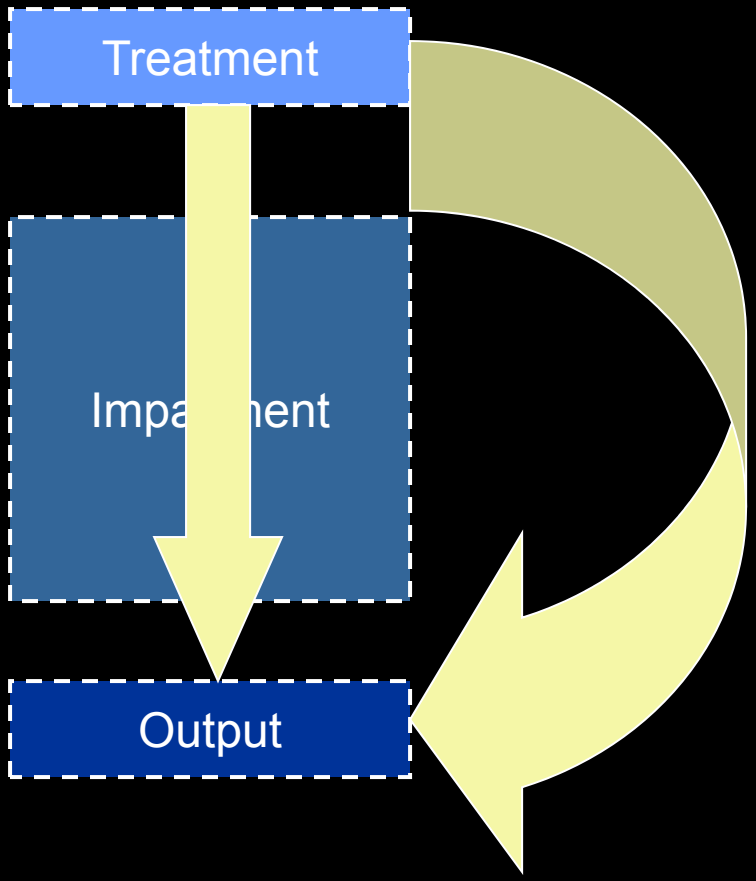
Treatment for lexical retreival deficits

Restitutive

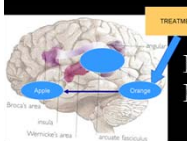
Reactivate or relearn aspects of language



Substitutive treatment

Engage intact systems to compensate for language impairment

Rothi (1995)



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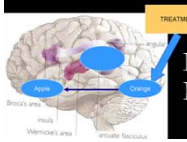
- Start with objects and provide tactile cues– start with repetition and fade repetition cues
- Semantic map for each item
  - Pre-set attributes, function, color, category, location,
- Semantic map for a specific category- have them name and generate
- Minimal pair contrast
- Rhyme judgment/processing
- Neologisms- work towards awareness
- Give them functional cues or assist with a gesture
- Use written naming as a self cue
- Ask them to visualize the target-
- Give them carrier phrases to choose
- Drawing the target word

- Categorization
- Semantic feature discrimination
- Generate features for superordinate category/example
- Category generation-describe category boundaries
- Synonyms and antonyms
- Connect semantic features to Phon Representation
- Phonemic Cueing
- Self Cueing
- Memorizing spelling of words
- Generate the initial grapheme of target
- Specific category features, separate out trained and untrained
- Have them write the target and read what they have written
- Rely on pictures
- Naming to definition task
- Verbal analogies



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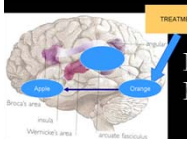
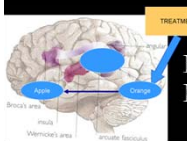
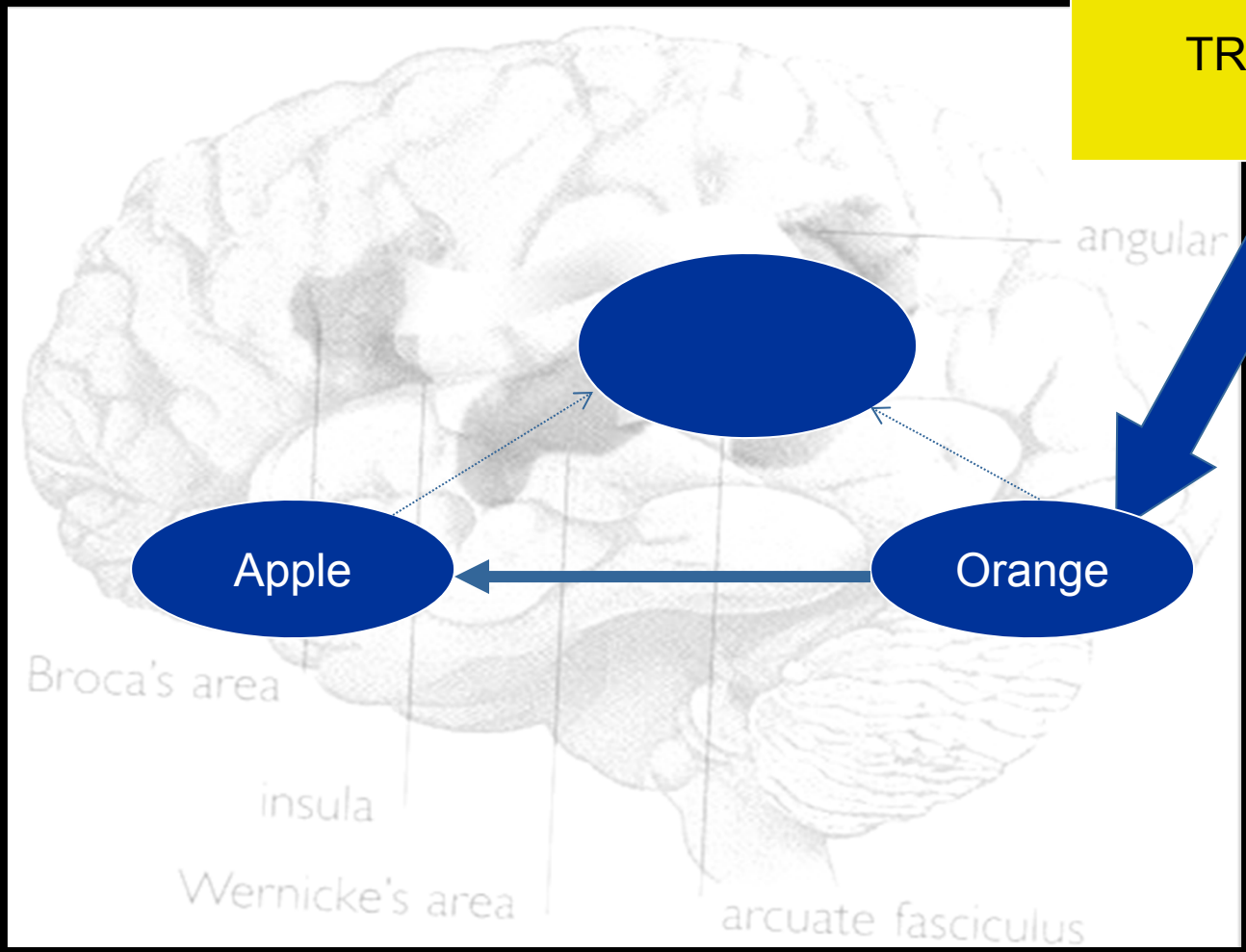


Why is this distinction important?

- Generalization to untrained items/contexts
- Long term maintenance of treatment effects
- Comparative effectiveness of treatment approaches



What is generalization??



Generalization

Within category generalization

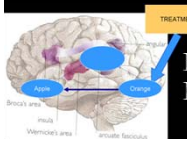
1. Complex to simple

Cross modal generalization

1. Reading-> naming, writing
2. Writing-> reading, naming

Cross language generalization

1. Trained to untrained language



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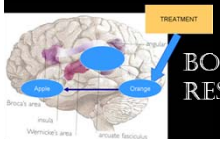
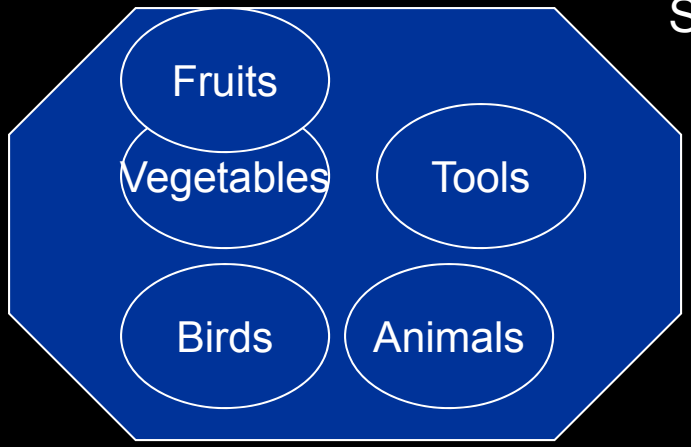


Generalization based on complexity



Semantic System

Complex

Simple

The man pushed the woman
(___) VERB (____)

Syntactic structure

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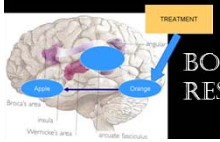
Complexity in Sentence structure

- Thompson et al., (1993).
  - WHO → WhaT
- Thompson et al., (1996).
  - WHO <-> WHAT
  - WHERE <-> WHEN
- Thompson et al., (1997)
  - Object clefts -> who questions
    - *It was the artist who the thief chased*
    - *Who did the thief chase?*
  - Passives -> subject raising
  - *The thief was chased by the artist*
  - *The thief seems to have been chased by the artist*
- Thompson, Shapiro, Kiran & Sobecks (2003):
- Object relative sentence -> Object clefts, WHO questions
  - *The man saw the artist who the thief chased*
  - *It was the artist who the thief chased*
  - *Who did the thief chase?*



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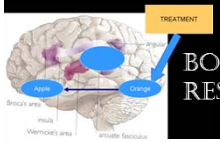

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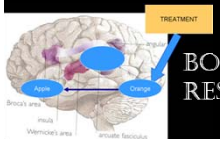

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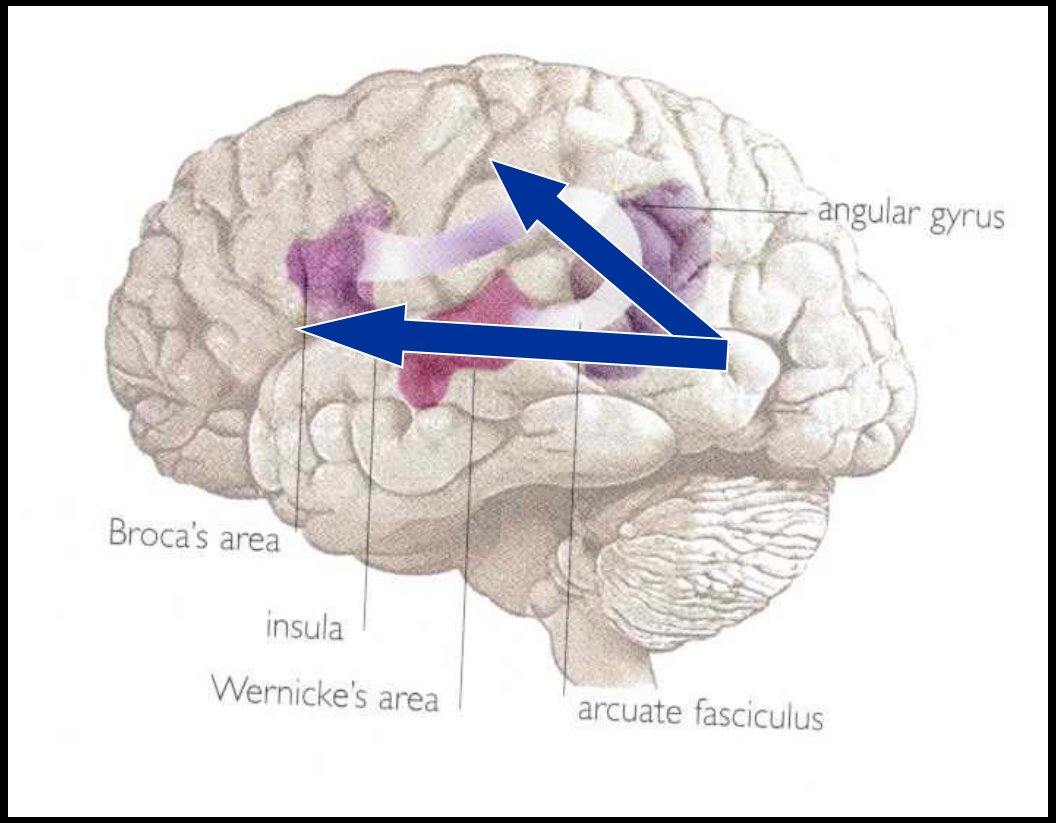

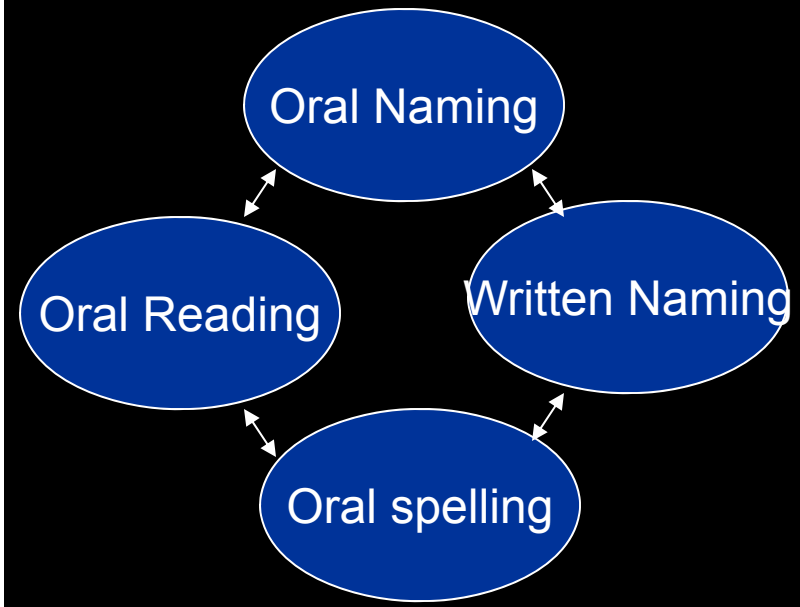

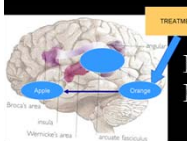

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Kiran, Thompson, Hashimoto, 2001;
Kiran, 2005;
Kiran & Viswanathan, 2008

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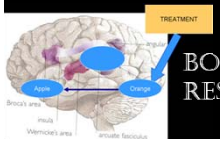

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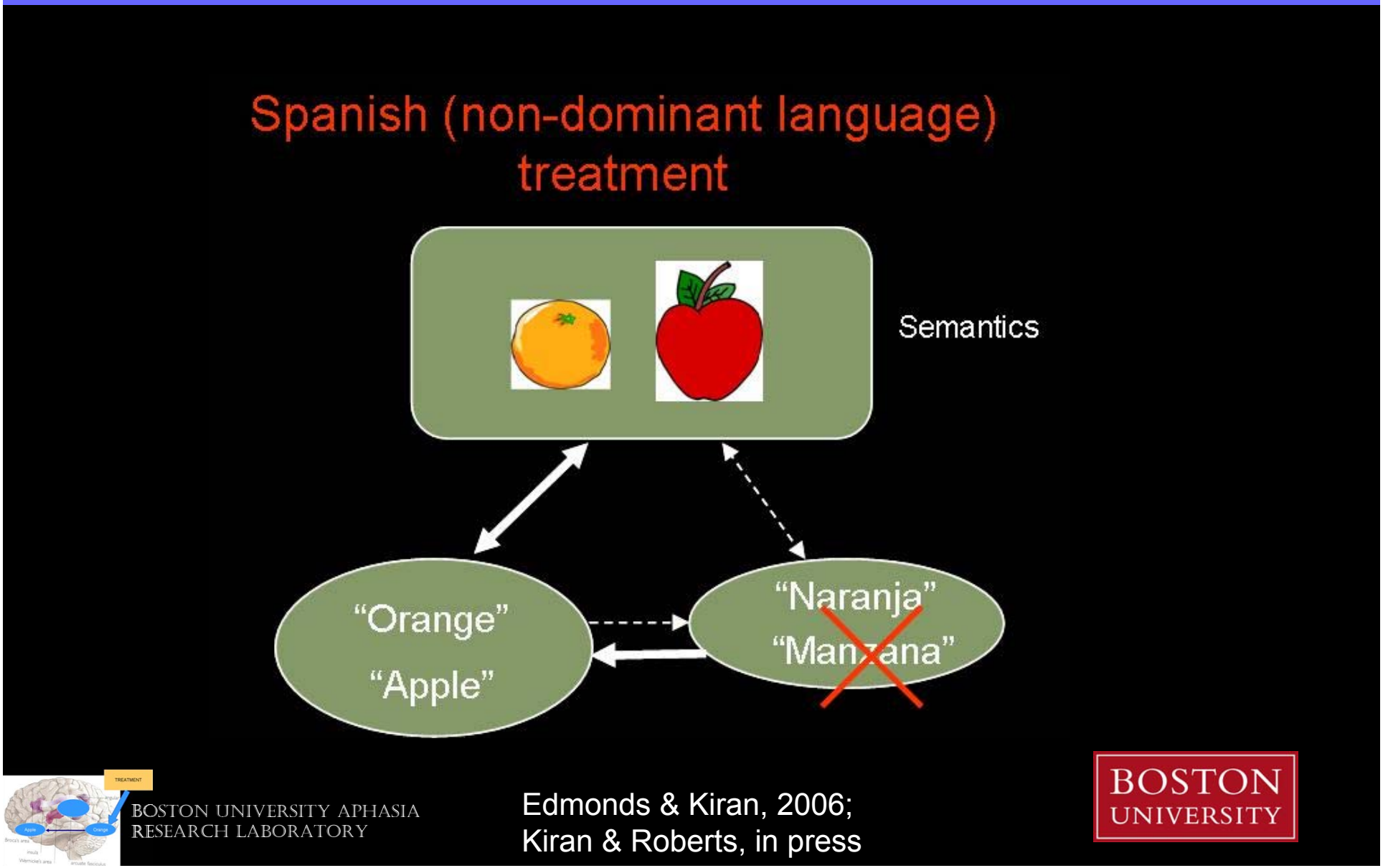
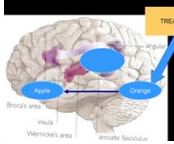


Edmonds & Kiran, 2006;
Kiran & Roberts, in press

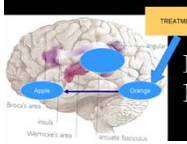
Generalization within category
The effect of exemplar typicality



Representation of typicality

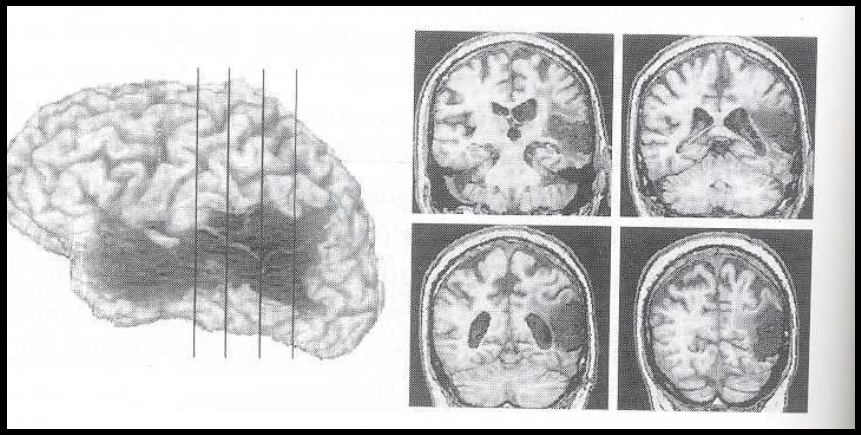
In normal individuals

- 1. Some examples are consistently rated more typical of the category than others (Rosch, 1975; Uyeda & Mandler, 1981)
- 2. Typical examples are produced more often to a category name (e.g., Hampton, 1995)
- 3. Typical examples are verified faster than atypical examples (Hampton, 1979, 1993; Rips et al., 1973; Rosch, 1975; Smith et al., 1974)



In Aphasia

- Patients with posterior aphasia present with difficulty at category boundaries and at activating the category prototype (Grober et al., 1980, Grossman, 1981)



Typicality effect in normal individuals and in patients with aphasia

Evidence for the typicality effect	
Category verification: “is robin a bird”?	Kiran & Thompson, 2003b; Kiran, Ntorou, & Eubank, 2007; Sebastian & Kiran (submitted)
Feature verification: “Does this bird fly?	Kiran & Allison (submitted)
Oral Naming: What kind of bird is this?	Kiran & Allison (submitted)
Treatment for naming deficits	Kiran & Thompson (2003a); Kiran, (under revision) Kiran & Johnson, (submitted)

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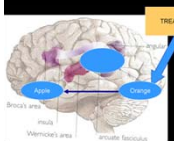
Assumption 1

Atypical examples represented further from the center in space

Measured by longer times for atypical examples compared to typical

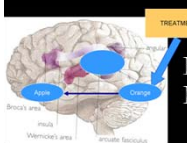


Animate categories

Inanimate categories

Assumption 2:

The nature and extent of typicality varies across different categories



Category verification task

750 ms

Shapes

ISI: 200 ms

Cylinder

Category-Typical

Females

Queen

Body parts

Finger

Shapes

Crescent

Category-Atypical

Females

Cowgirl

Body parts

Liver

Shapes

Canary

Category-Nonmember

Females

Ferry

Body parts

Shark

Shapes

Rhugged

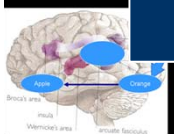
Category-Nonword

Female

Skorks

Body parts

Yaked



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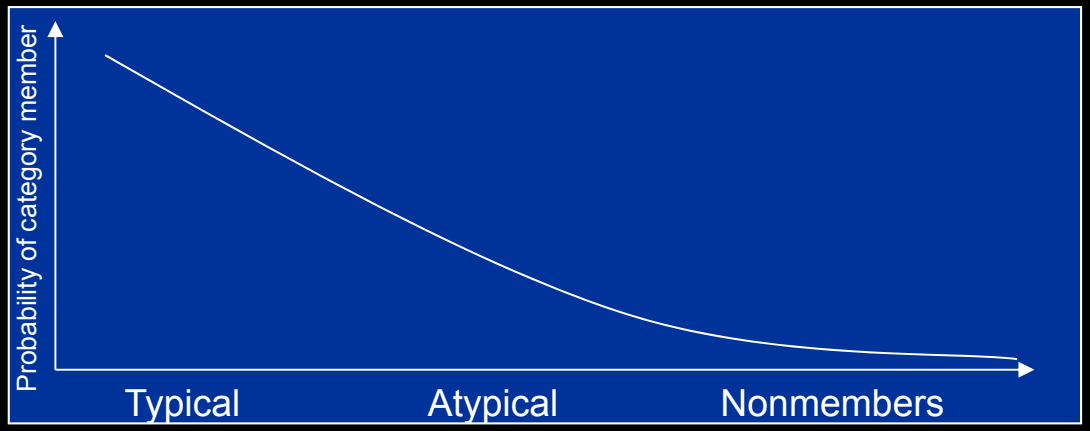
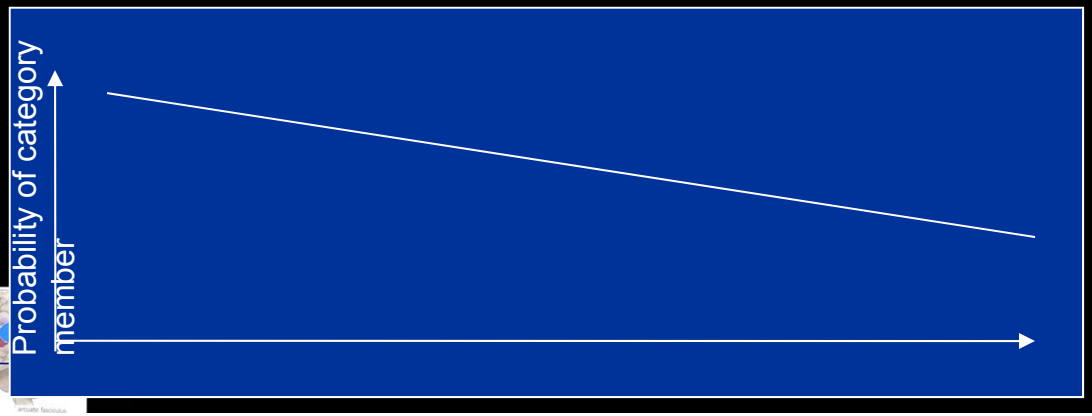


Living categories: Birds
(Kiran & Thompson, 2003)
Nonliving categories: Clothing
(Kiran, Ntourou, & Eubank, 2007)

Well defined categories: Odd Numbers
(Kiran, Johnson & Bassetto, 2006)



Ad hoc categories: Things at a garage sale
(Sebastian & Kiran, 2007)

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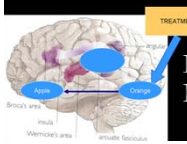
Interim Summary

- Typicality effects in normal individuals replicate existing work
- Patients with aphasia also sensitive to typicality effects
  - Except well defined categories
- The nature of typicality in aphasia appears to depend upon whether patients present with co-existing semantic impairments



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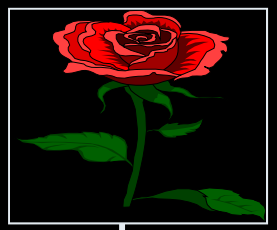
Framework for lexical access



Semantic representation

- Activation of network of features
- Influenced by frequency, imageability, animacy

- Sequential: 2 stages (Levelt, 1989)
- Interactive: Bi-directional links (Dell, 1986)

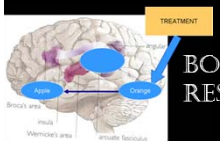
Phonological representation

Activation of corresponding address

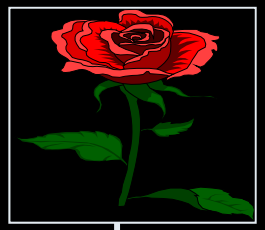
or

Activation of potential nodes

Phoneme level



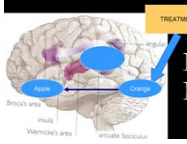
Treatment for naming deficits



Semantic representation

Phonological representation

Phoneme level



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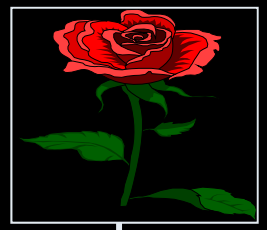
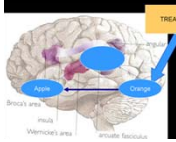


Semantic representation

Phonological representation

Phoneme level



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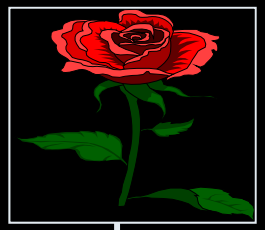
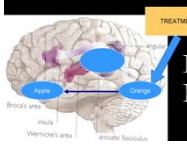


Semantic representation

Phonological representation

Phoneme level

- Semantic based treatment results in improvements in retrieval of phonological representations
- Facilitates generalization to trained and untrained items (Boyle & Coehlo, 1995; Coehlo et al., 2000; Drew & Thompson, 1999; Kiran & Thompson, 2003)



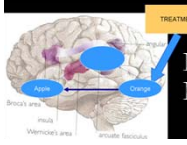
Framework for treatment

Semantic representation

Phonological representation

Phoneme level

Features for the category clothing
- Worn in warm weather
- Has buttons
- Has zippers
- Decorative accessory
- Optional
- Protective covering
- Worn by women



Kiran & Bassetto (2008)

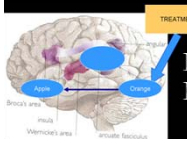
Semantic representation

Phonological representation

/pants/
/sweater/

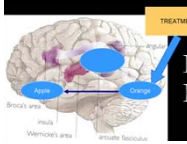
/suspenders/
/apron/

Phoneme level



Kiran & Bassetto (2008)

Selective generalization patterns



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Kiran & Bassetto (2008)

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Schedule of treatment for each participant

Pre –treatment assessment:
Western Aphasia Battery, Boston Naming Test

Baselines: Naming examples across consecutive sessions

No feedback provided

Treatment on one category-typicality

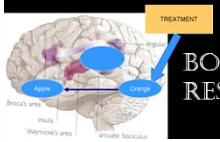
Session 1: Training
Session 2: Testing & Training
Session 2: Testing & Training
Session 2: Testing & Training
Session 2: Testing & Training

Week 1
Week 2
Week 3
Week 4

Session 1: Training
Session 2: Testing & Training

Until 80% accuracy achieved on items trained

Post treatment assessment:
Standardized language tests



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Kiran & Bassetto (2008)

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No feedback provided

Treatment on one category-typicality

e.g.,

Train naming of atypical examples of birds

Test naming of atypical and typical examples of birds

Session 1: Training
Session 2: Testing & Training

Session 2: Testing & Training

Session 2: Testing & Training

Session 2: Testing & Training

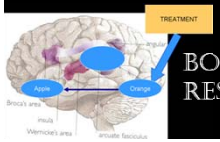
Week 1
Week 2
Week 3
Week 4

No feedback provided regarding accuracy

Session 1: Training
Session 2: Testing & Training

Until 80% accuracy achieved on items trained

Pre –treatment assessment:
Standardized language tests



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Kiran & Bassetto (in press)

Treatment Protocol

- Sorting word cards by category
- Select target word (N = 15)
- Patient asked to generate 5 features for target item
- Select 6 written semantic features from distracters for each target
- Respond to 15 auditorily presented questions
  (5 accurate, 5 inaccurate, 5 distracter)
- Word recall of trained items

Garage sale /Not in garage sale

Jewelry

Can become old fashioned

Have too many of these

Unwanted/Not needed

Outdated

Things that are passed on

Personal grooming

Can buy at a mall

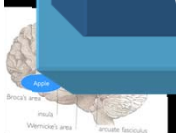
Things that get lost

Is it an electronic item

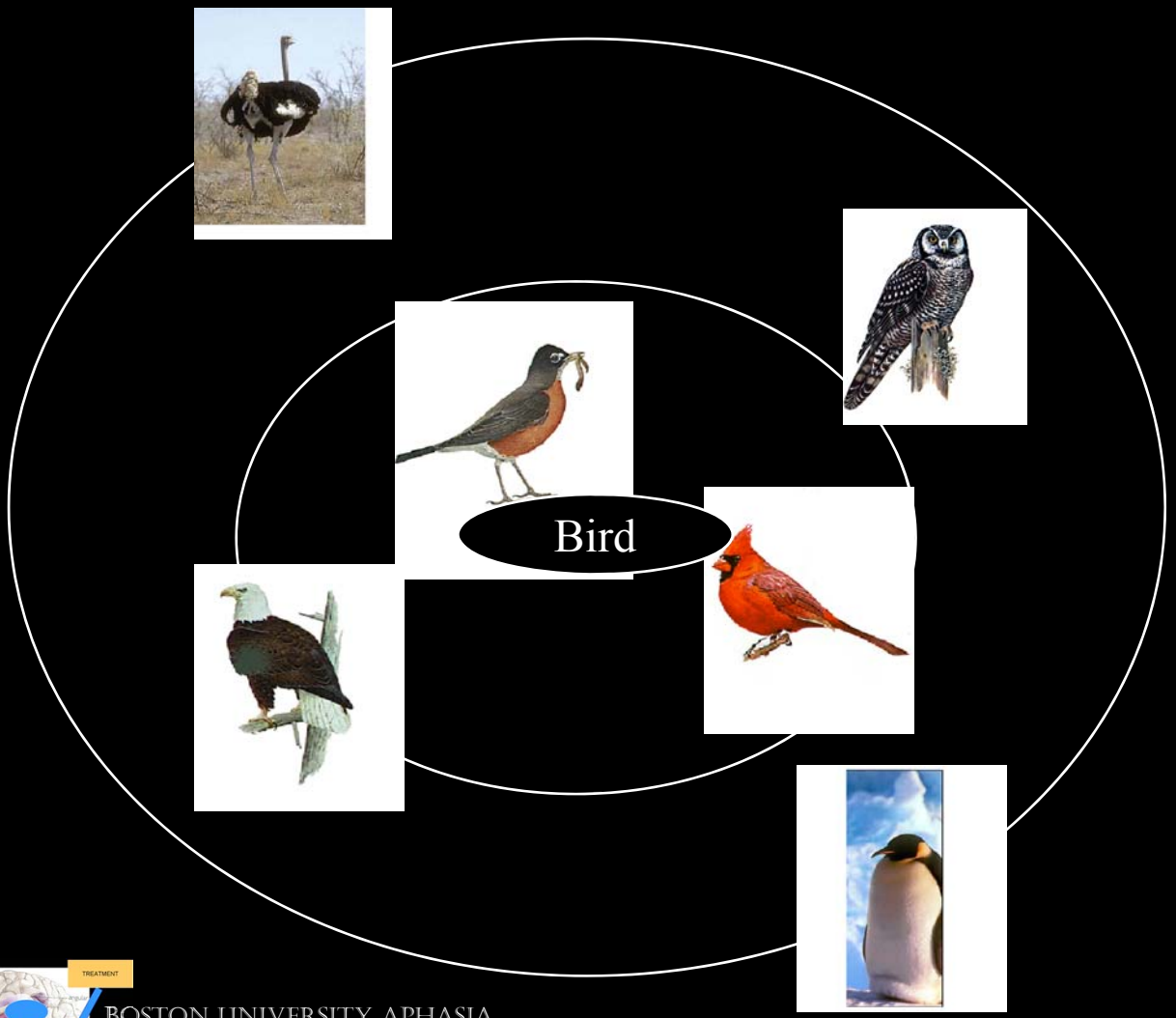
Is it for entertainment

Does it live in trees?

What are we talking about? Jewelry



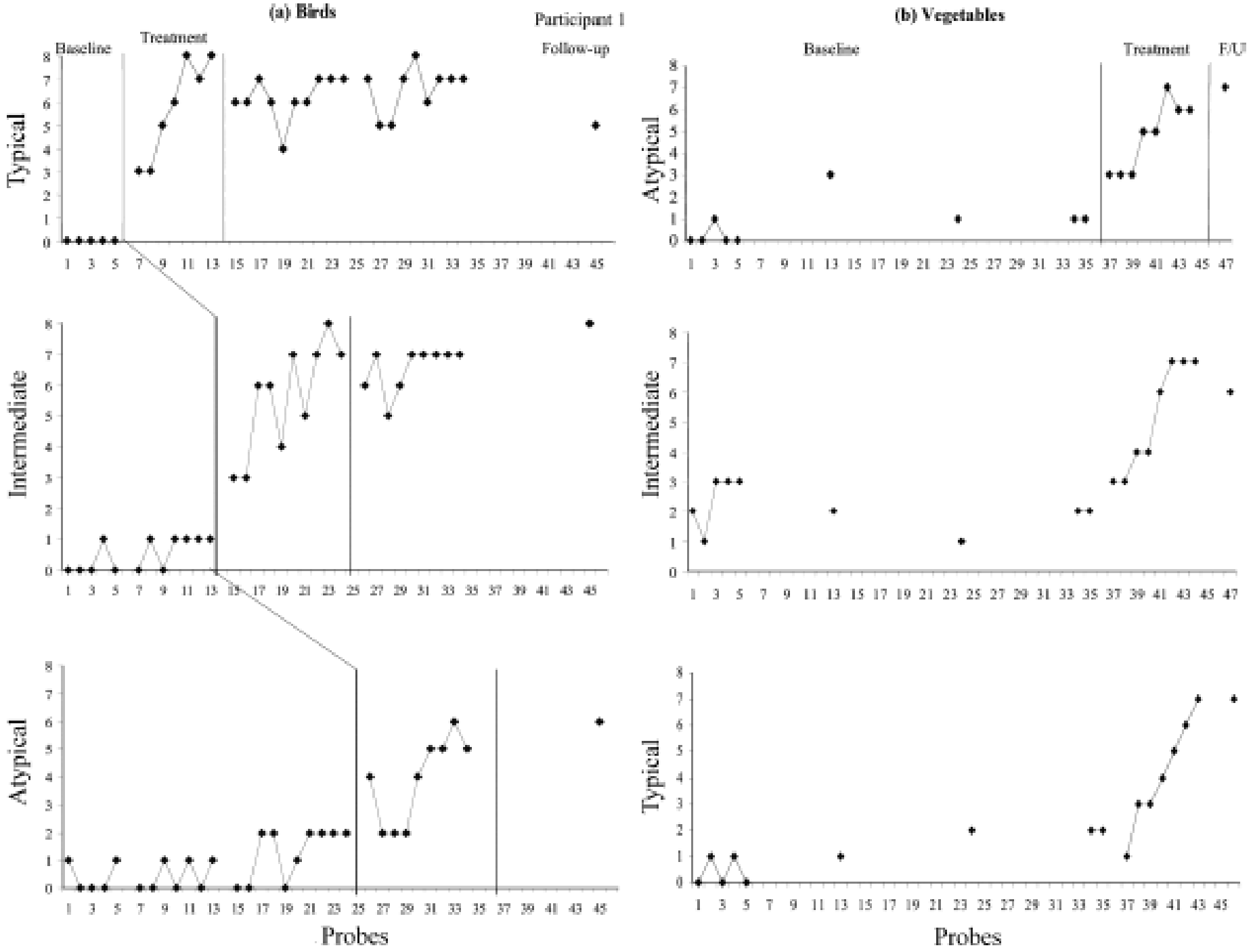
Animate categories



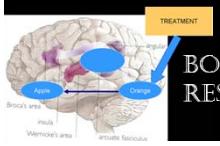
Features for the category <u>birds</u>:

- •wings
- •flies
- •two legs
- •lays eggs
- •feathers
- •builds nest
- •sings
- •feathers
- •beak
- •nocturnal
- •eats insects
- •eats fish
- •claws
- •webbed feet
- •Swims

(Garrard et al., 2001; Kiran, 2002; McRae et al., 1997)


(a) Birds
Participant 1
Baseline
Treatment
Follow-up
Typical
Intermediate
Atypical
Probes
(b) Vegetables
Baseline
Treatment
F/U
Atypical
Intermediate
Typical
Probes

Participant	Pre tx WAB AQ	Time post onset CVA (months)	Category Trained	Generalization trends
Animate categories (Kiran & Thompson, 2003a)				
P1	43.4	99	1. Birds	Typical ≠› Atypical
			2. Vegetables	Atypical => Typical
P2	50.9	13	1. Birds	Atypical => Typical
			2. Vegetables	Atypical => Typical
P2	70	9	1. Vegetables	Typical ≠› Atypical
P4	46.4	14	1. Vegetables	Atypical => Typical
			2. Birds	Atypical => Typical



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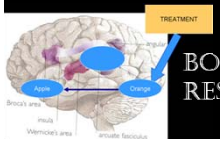

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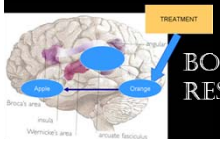
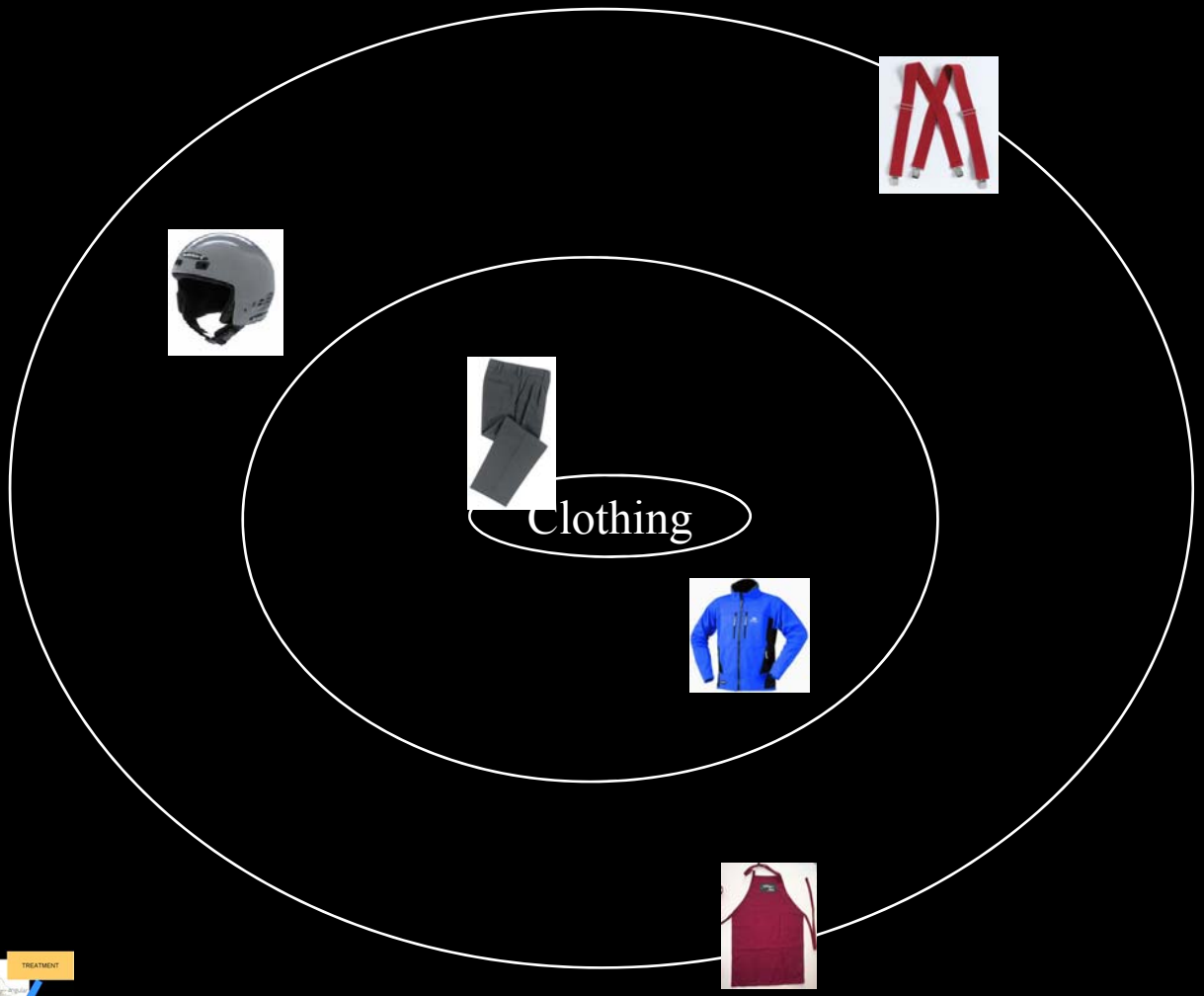
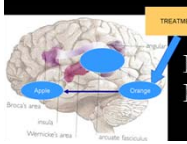


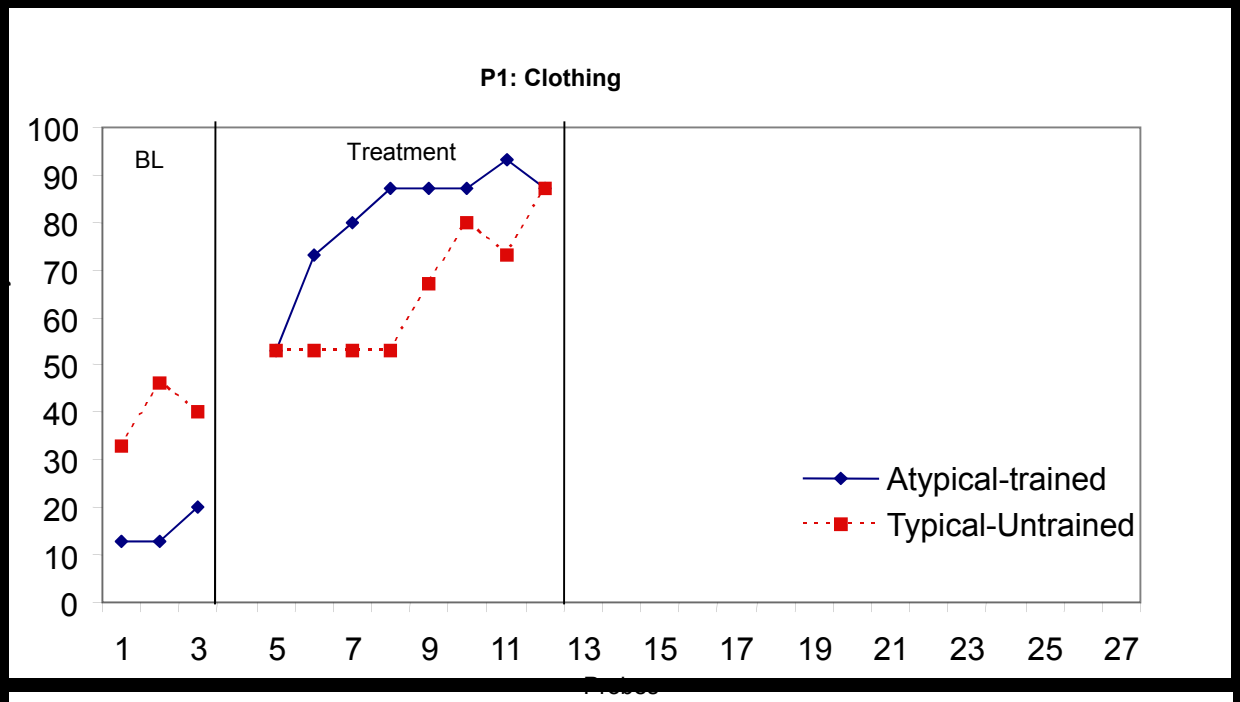
Clothing/Furniture



Features for the category clothing
- Worn in warm weather
- Has buttons
- Has zippers
- Decorative accessory
- Optional
- Protective covering
- Worn by women

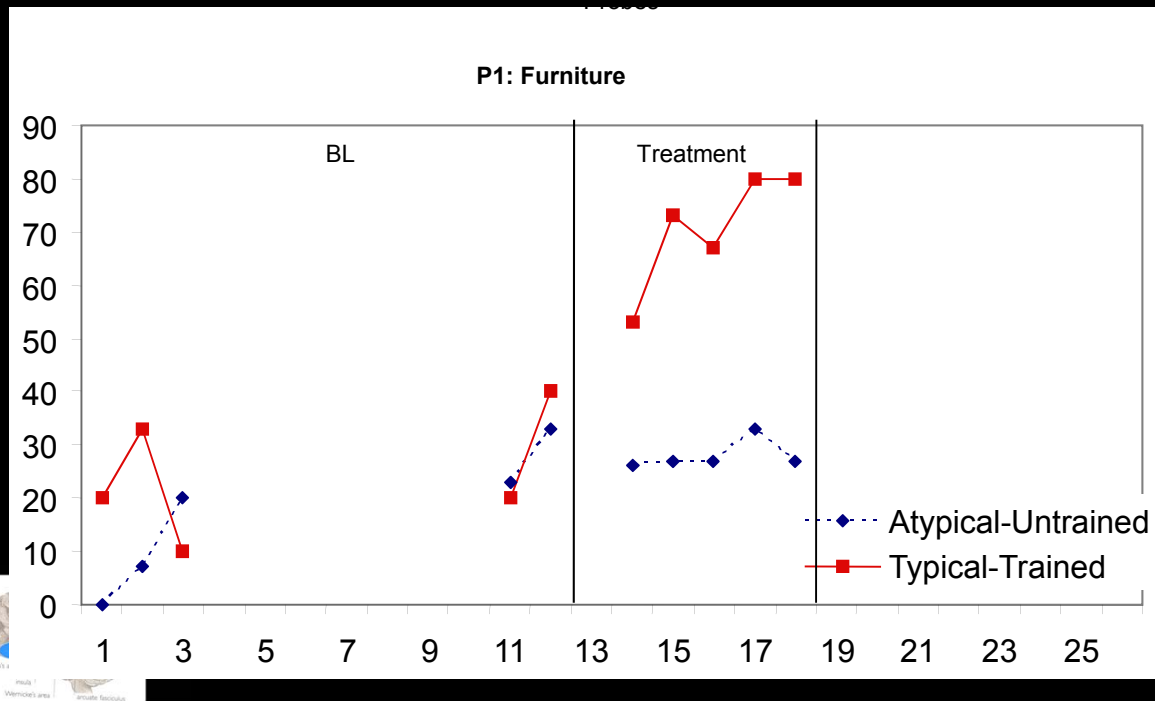


Kiran (2008)



Typical

Atypical



Typical

Atypical

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Kiran (2008)

Participant	Pre tx WAB AQ	Time post onset CVA (months)	Category Trained	Generalization trends
Inanimate categories (Kiran, submitted)				
P1	56.7	9	1. Clothing	Atypical => Typical
			2. Furniture	Typical ≠› Atypical
P2	72.5	7	1. Furniture	Typical ≠› Atypical
P3	62.2	7	1. Furniture	Atypical ≠› Typical
			2. Clothing	Typical ≠› Atypical
P4	46.4	9	1. Clothing	Typical ≠› Atypical
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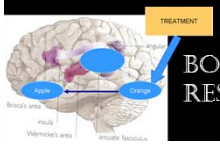
P5	37	8	1. Furniture	Atypical => Typical



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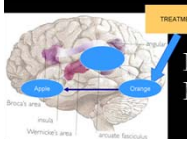

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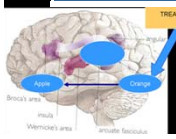
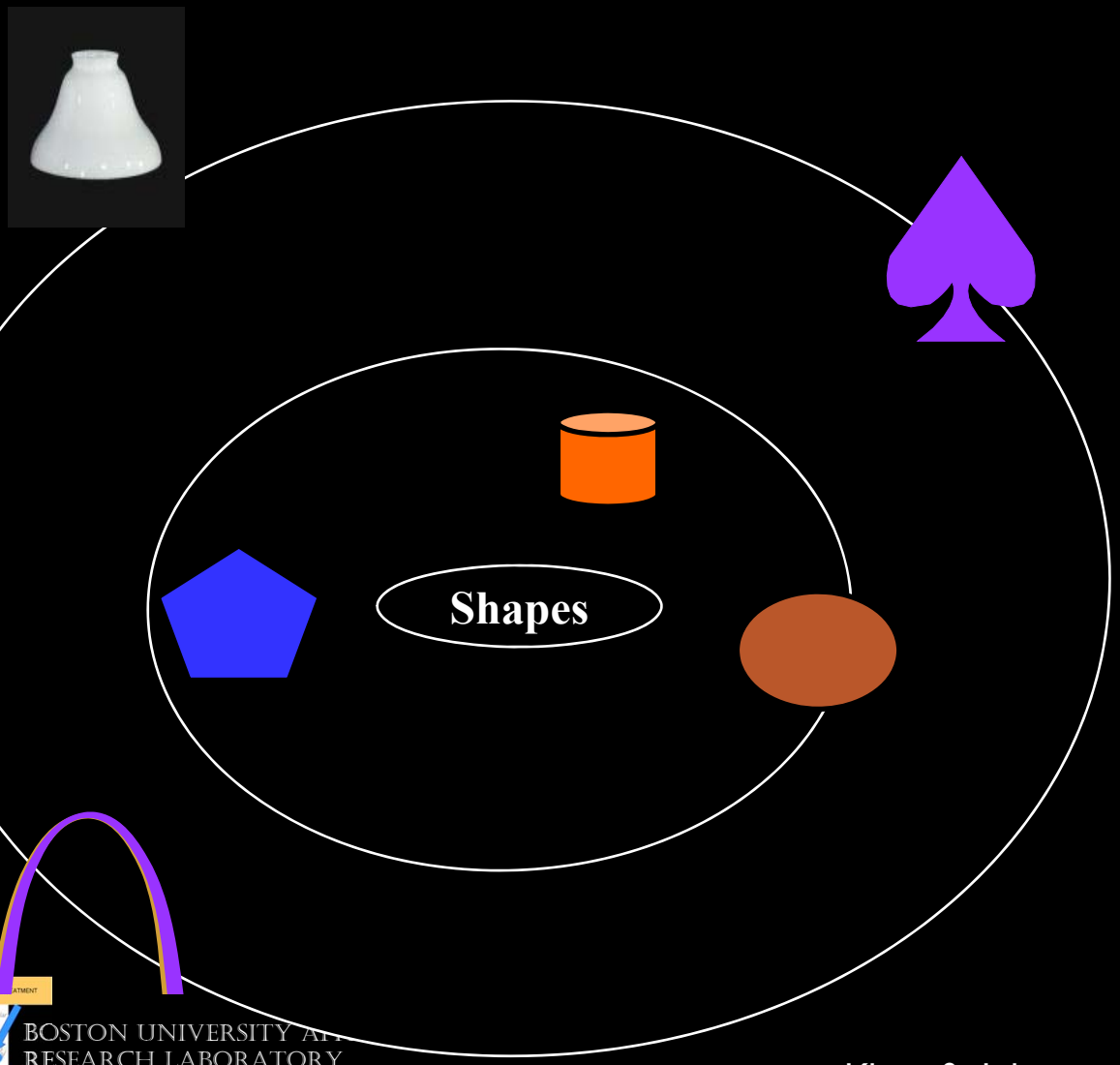


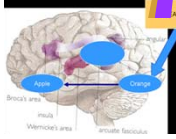
Kiran (2008)

Well defined categories have a clear definition and clear boundaries

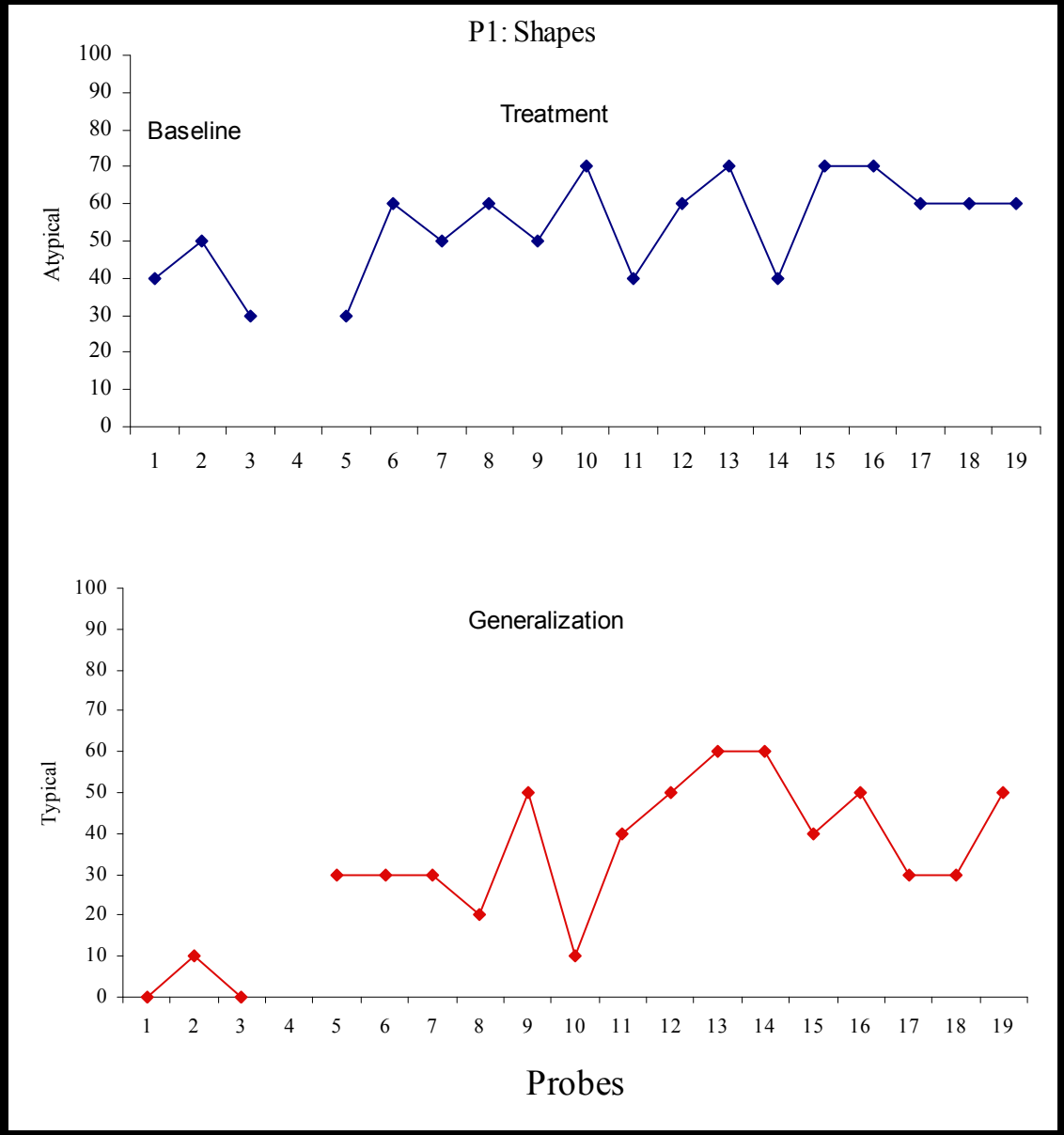


Features for Shapes

1. Is a closed figure
2. Has sides
3. It is round
4. Is 3 dimensional
5. Has angles
6. Has lines
7. Has curves
8. Has diameter
9. Can bisect
10. acute angles

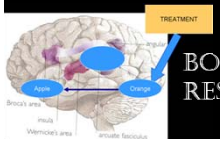


Kiran & Johnson (2008)



Atypical

Typical



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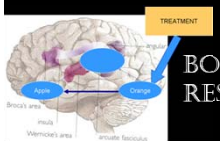
Kiran & Johnson (2008)

Participant	Pre tx WAB AQ	Time post onset CVA (months)	Category Trained	Generalization trends
Well define categories (Kiran & Johnson, submitted)				
P1	82.5	11	1. Shapes	Atypical => Typical
P2	84.3	7	1. Shapes	Typical ≠› Atypical
P3	87.3	36	1. Shapes	Atypical => Typical



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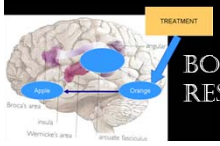

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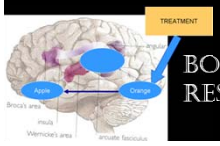
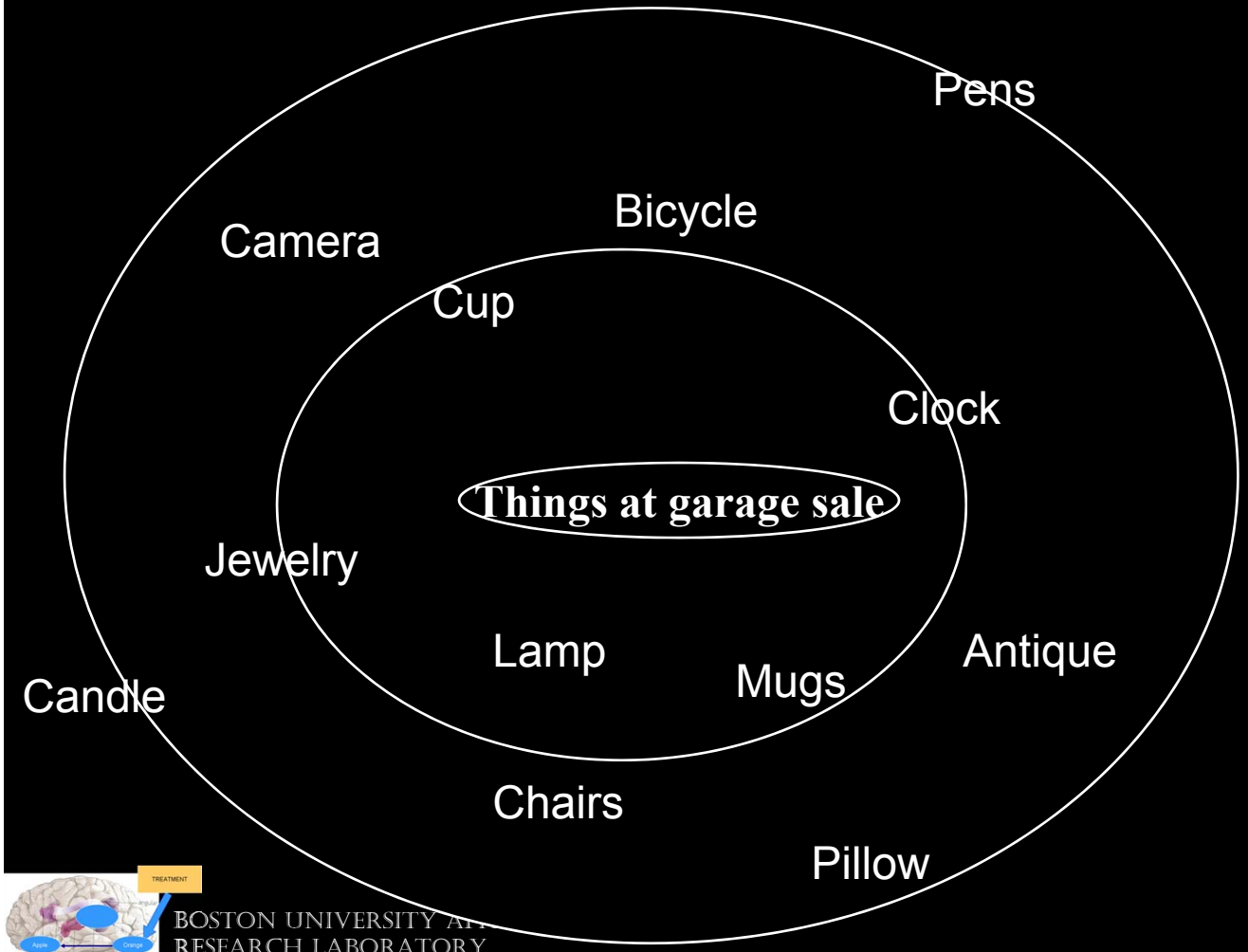
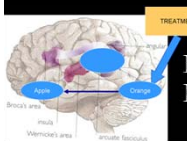


Kiran & Johnson (2008)

Ad hoc categories



- Entertainment
- Items for travel
- Household items
- Memorabilia
- Unwanted/not needed
- For kids
- Things with newer formats
- Things that get replaced
- Things for reading



Dependent variable in baseline and treatment probes: Generative naming of category items

"Please name as many items that you could have in a garage sale"

Typical items (N =15)

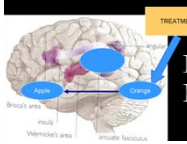
Atypical items (N =15)

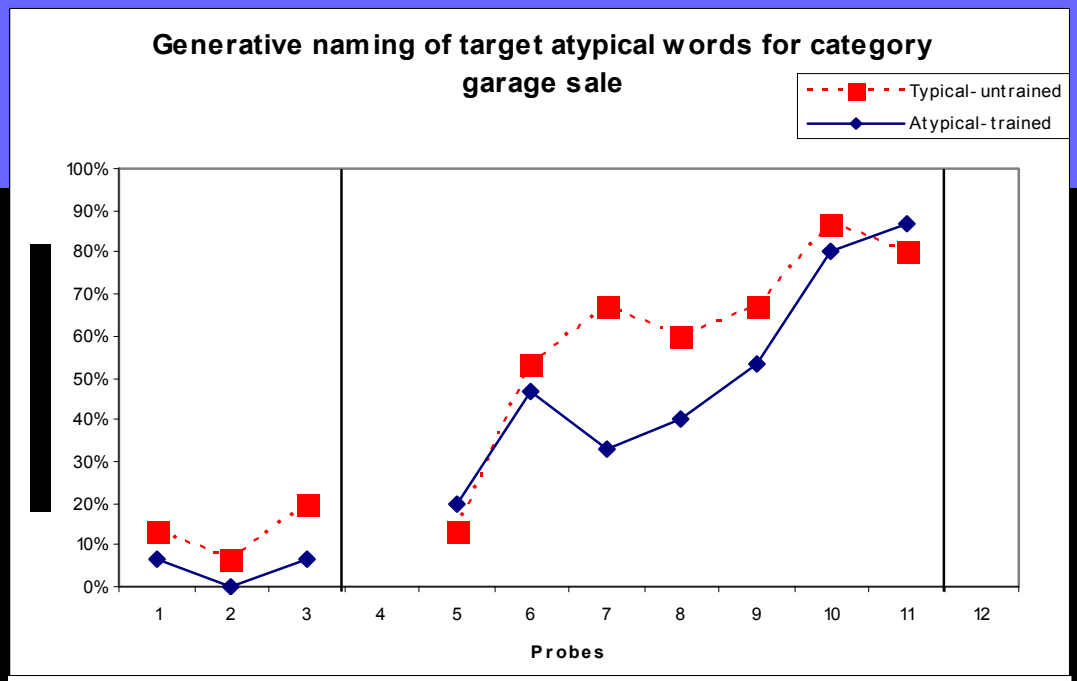
Normed for variables

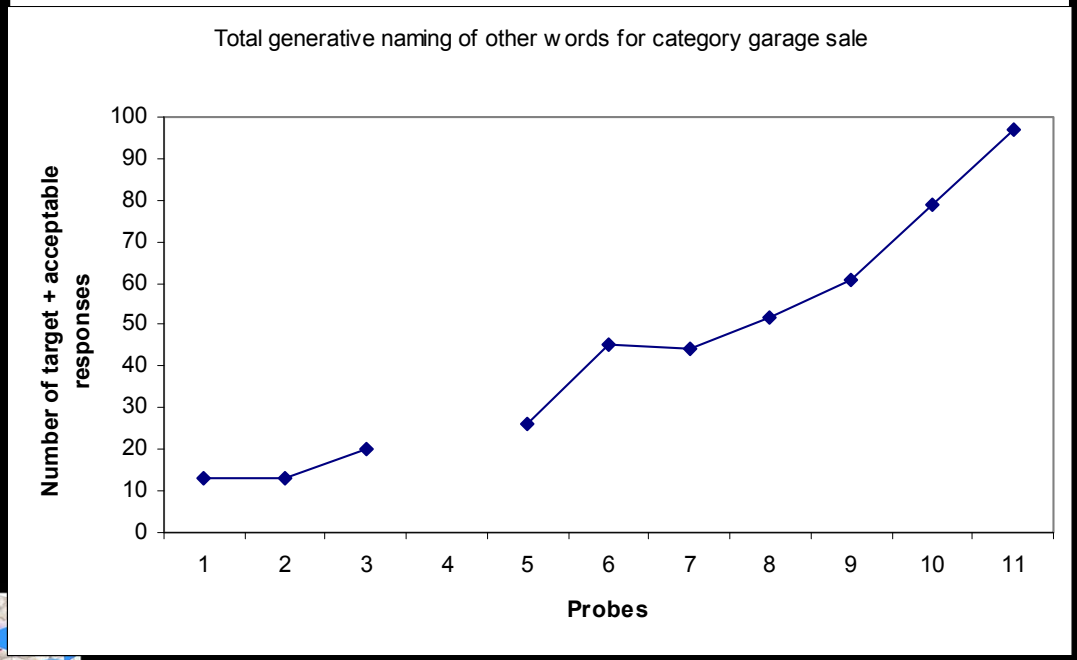
Other items in the category that were generated by participant

Not normed

Classification of responses into subcategories (N = 10) (e.g., kitchen items, home/garden)







Things to have at garage sale

Typical	Atypical
Pants	Antiques,
Jewelry	Camera
Clock	Movies
	Candle

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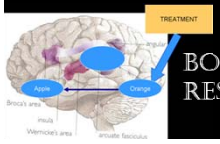
Summary: Treatment effects

Participant	Age	Pre tx WAB AQ	Time post onset CVA (months)	Category Trained	Generalization trends
P1	76	79	30	1. Things at garage sale	Atypical => Typical
P2	39	82	6	1. Things to take camping	Atypical => Typical
				2. Things at garage sale	Typical => Atypical
P3	76	84.3	108	1. Things at garage sale	Atypical => Typical
P4	69	72.1	10	1. Things to take camping	* Typical ≠› Atypical
				2. Things at garage sale	* Atypical => Typical
P5	84	70.9	9	1. Things to take camping	* Typical ≠› Atypical
P6	64	84.8	96	1. Things at garage sale	Atypical => Typical



* Did not achieve tx criterion of 80% accuracy across 2 sessions

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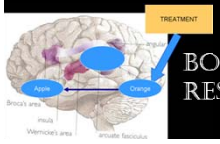

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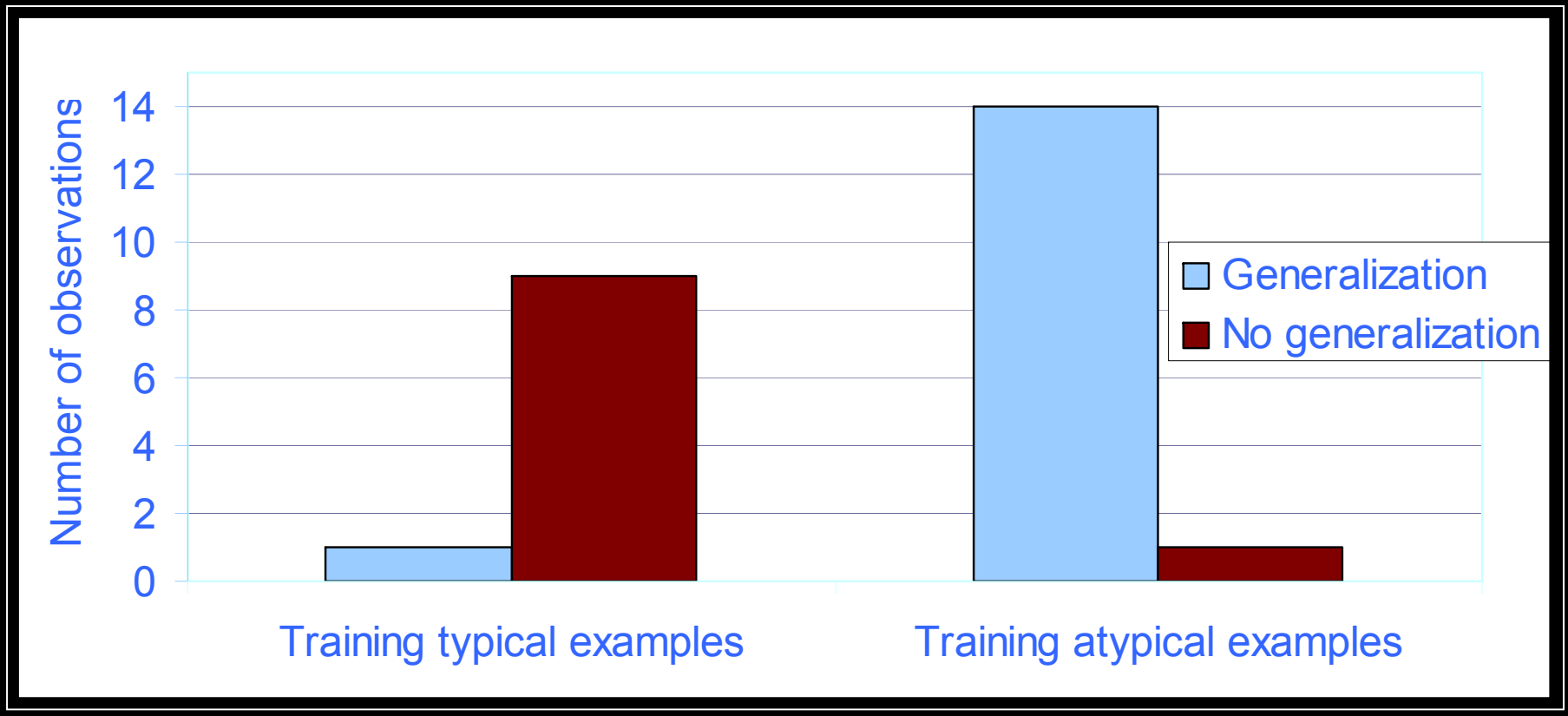
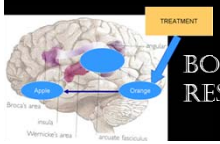
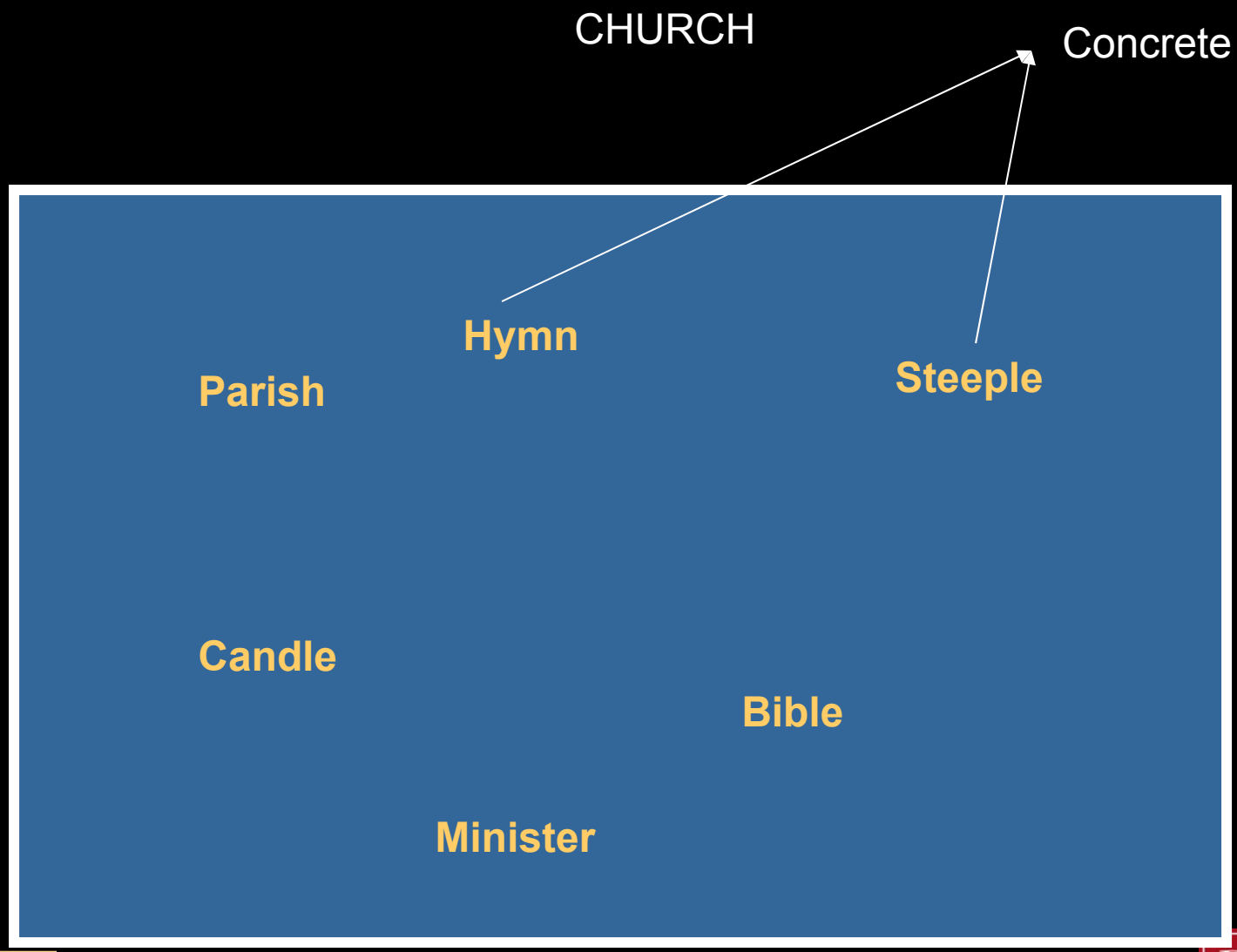
Summary of treatment studies





Theoretical Assumption



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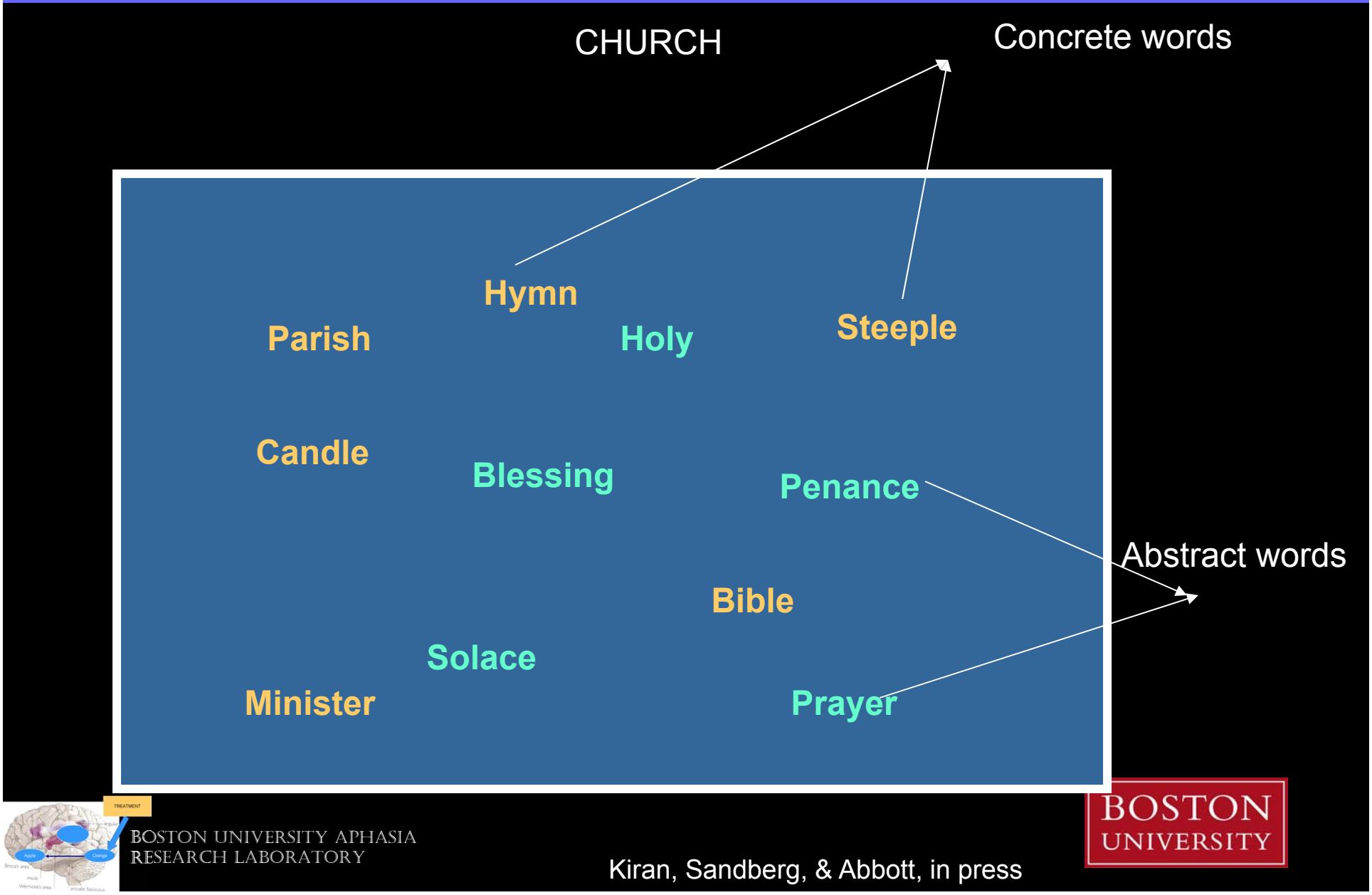
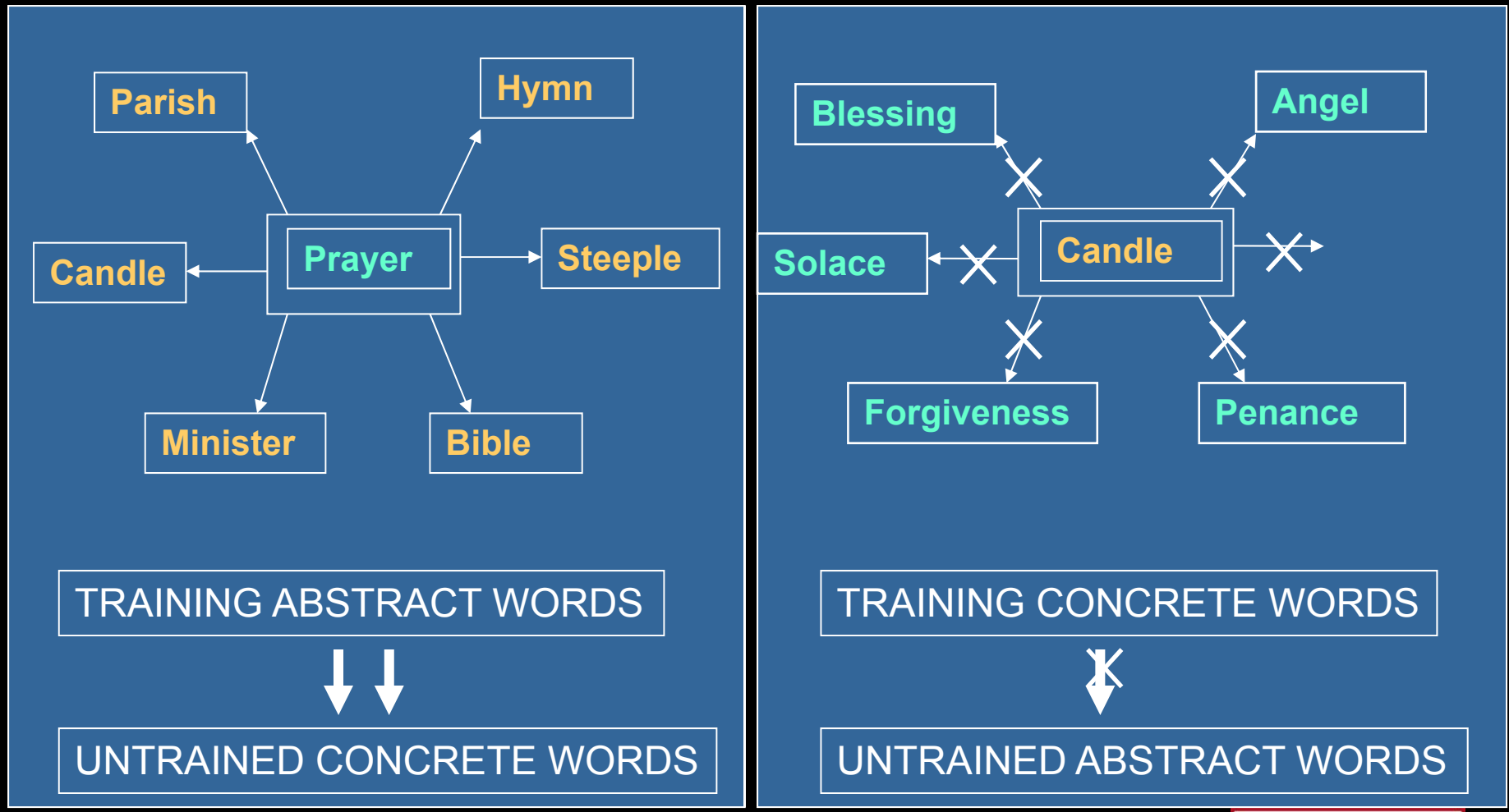


Hypothesis and Predictions



Treatment Protocol

Sorting word cards by related location

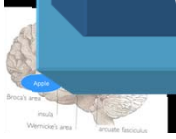
Select target word (N = 10)

Select 6 written semantic features from distracters for each target

Respond to 15 auditorily presented questions

(5 accurate, 5 inaccurate, 5 distracter)

Word recall of trained items



Church, Courthouse and Hospital

Minister

Is alive	Has a physical presence
Can be seen	Conveys important messages
Can be touched	Exists outside the mind

Is it associated with heaven?

Is it a place to pray?

Does it live in trees?

What are we talking about? Minister

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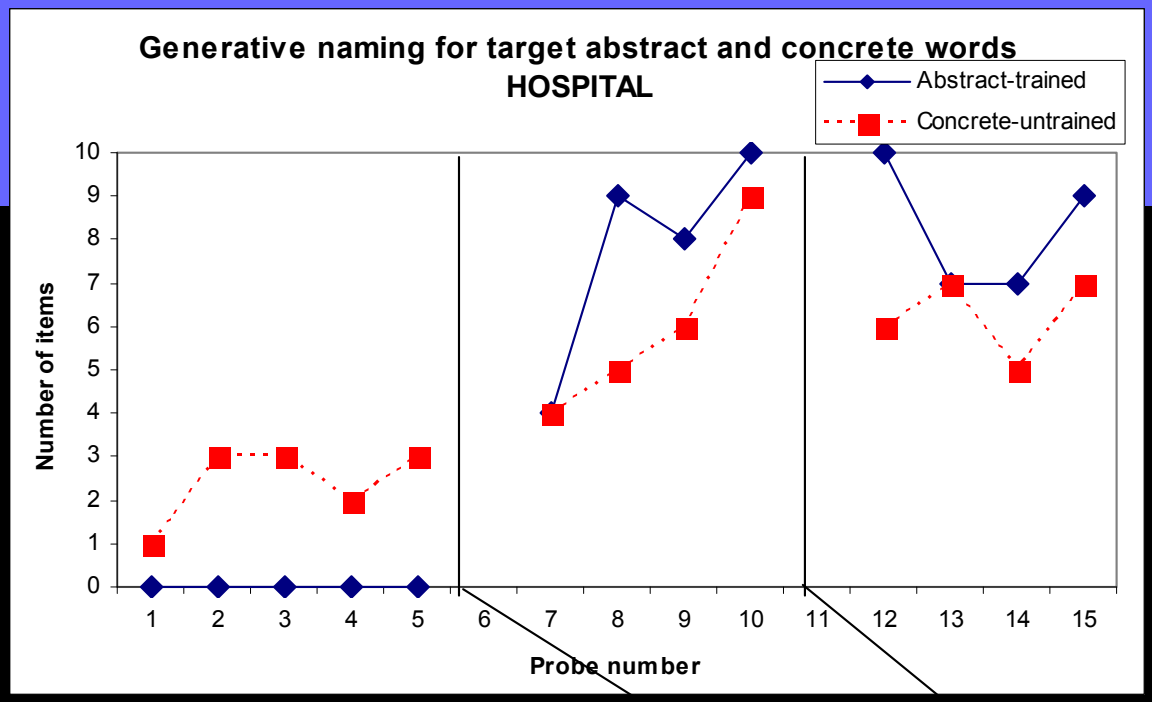
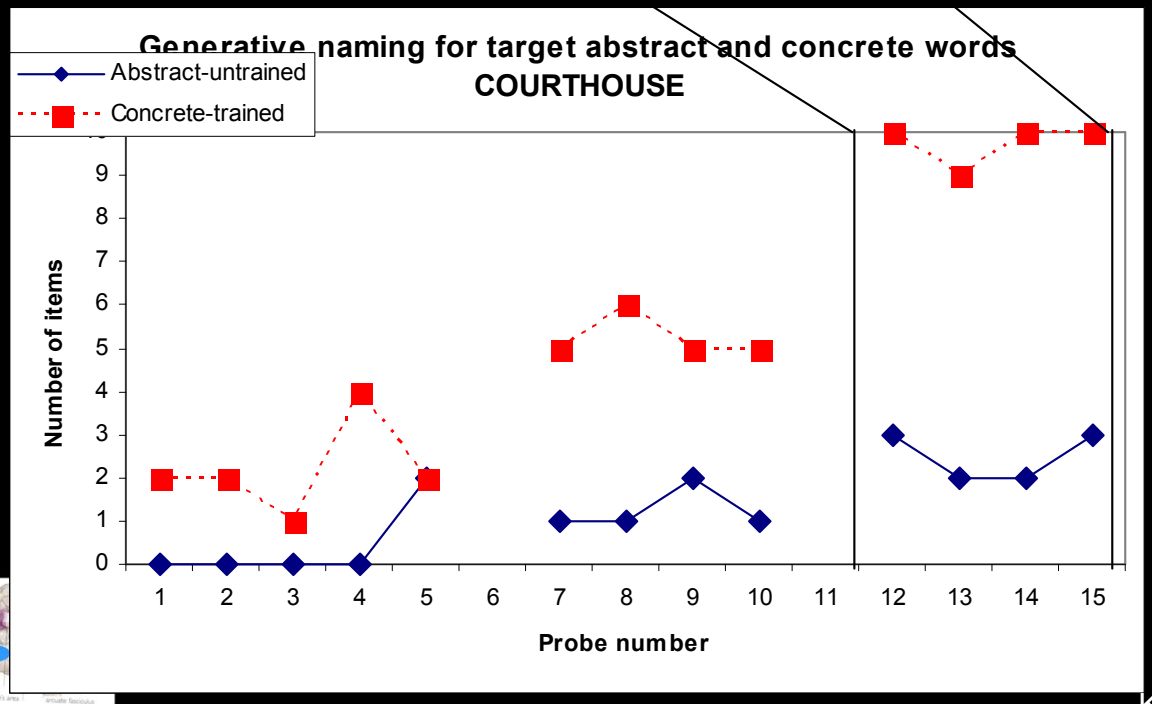
Kiran, Sandberg, & Abbott, in press

P3



HOSPITAL
- Trained abstract ES = *
- Untrained concrete ES = 4.2



COURTHOUSE
- Trained concrete ES = 6.89
- Untrained abstract ES = 2.3

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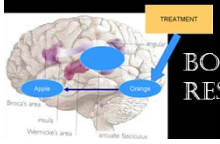
Kiran, Sandberg, & Abbott, in press

Summary of results

Ps	Category trained	Typicality trained	Generalization patterns observed	
P1	1. Church	Abstract	Abstract ≠› Concrete	No learning, no generalization
	2. Hospital	Concrete	Concrete ≠› Abstract	No learning, no generalization
P2	1. Church	Abstract	Abstract => Concrete	Generalization
	2. No treatment			
P3	1. Hospital	Abstract	Abstract => Concrete	Generalization
	2. Courthouse	Concrete	Concrete ≠› Abstract	No generalization
P4	1. Church	Concrete	Concrete ≠› Abstract	No generalization
	2. Hospital	Abstract		



Summary of results

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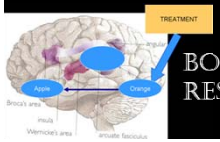
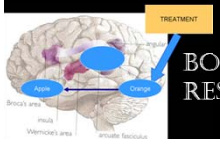
	2. Hospital	Concrete	Concrete ≠› Abstract	No learning, no generalization
P2	1. Church	Abstract	**Abstract => Concrete**	Generalization
	2. No treatment			
P3	1. Hospital	Abstract	**Abstract => Concrete**	Generalization
	2. Courthouse	Concrete	Concrete ≠› Abstract	No generalization
P4	1. Church	Concrete	Concrete ≠› Abstract	No generalization
	2. Hospital	Abstract	**Abstract => concrete**	Generalization

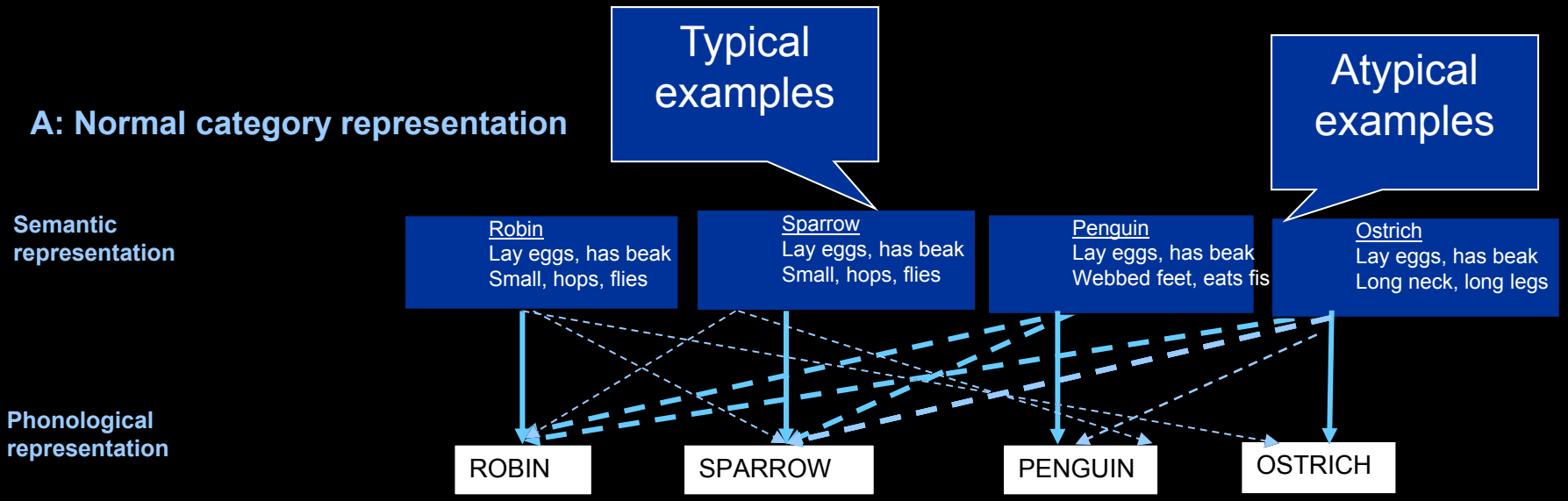


Summary of results

Ps	Category trained	Typicality trained	Generalization patterns observed	
P1	1. Church	Abstract	Abstract ≠› Concrete	No learning, no generalization
	2. Hospital	Concrete	**Concrete ≠› Abstract**	No learning, no generalization
P2	1. Church	Abstract	Abstract => Concrete	Generalization
	2. No treatment			
P3	1. Hospital	Abstract	Abstract => Concrete	Generalization
	2. Courthouse	Concrete	**Concrete ≠› Abstract**	No generalization
P4	1. Church	Concrete	**Concrete ≠› Abstract**	No generalization
	2. Hospital	Abstract		



A: Normal category representation



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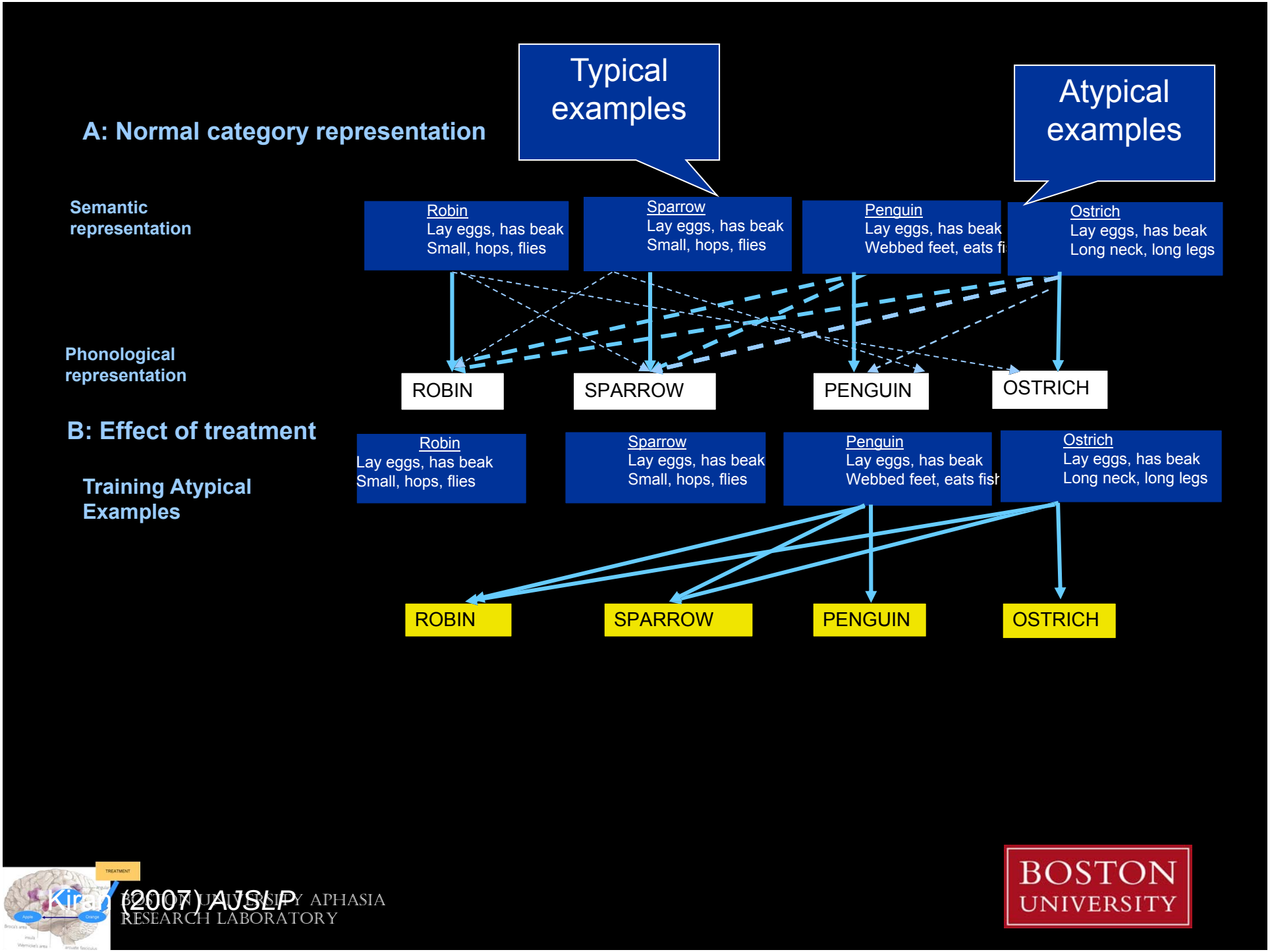
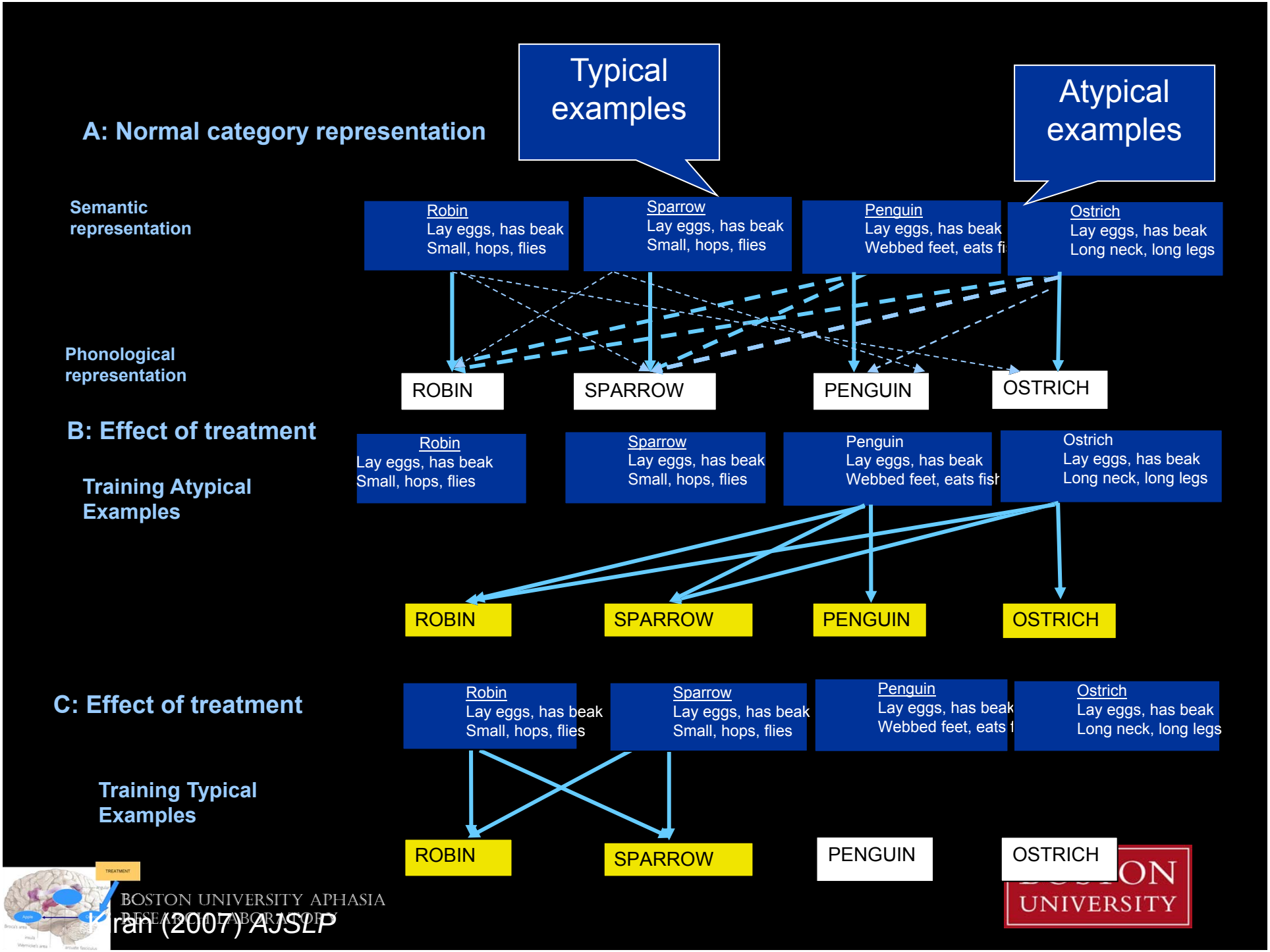

A: Normal category representation
Typical examples
Atypical examples
Semantic representation
Robin
Lay eggs, has beak
Small, hops, flies
Sparrow
Lay eggs, has beak
Small, hops, flies
Penguin
Lay eggs, has beak
Webbed feet, eats fi
Ostrich
Lay eggs, has beak
Long neck, long legs
Phonological representation
ROBIN
SPARROW
PENGUIN
OSTRICH
B: Effect of treatment
Training Atypical Examples
Robin
Lay eggs, has beak
Small, hops, flies
Sparrow
Lay eggs, has beak
Small, hops, flies
Penguin
Lay eggs, has beak
Webbed feet, eats fish
Ostrich
Lay eggs, has beak
Long neck, long legs
ROBIN
SPARROW
PENGUIN
OSTRICH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TREATMENT
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- Training atypical examples may be more efficient than typical examples to facilitate within category generalization
- Patients also show consistent improvements on language measures
- Are behavioral changes associated with functional changes in the brain?
- What are regions that can support behavioral language recovery after treatment?